MICROTURBINES

www.microturbine.com

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Power when and where you need it.
Clean and simple.

DG:
Small-Scale On-Site Generation

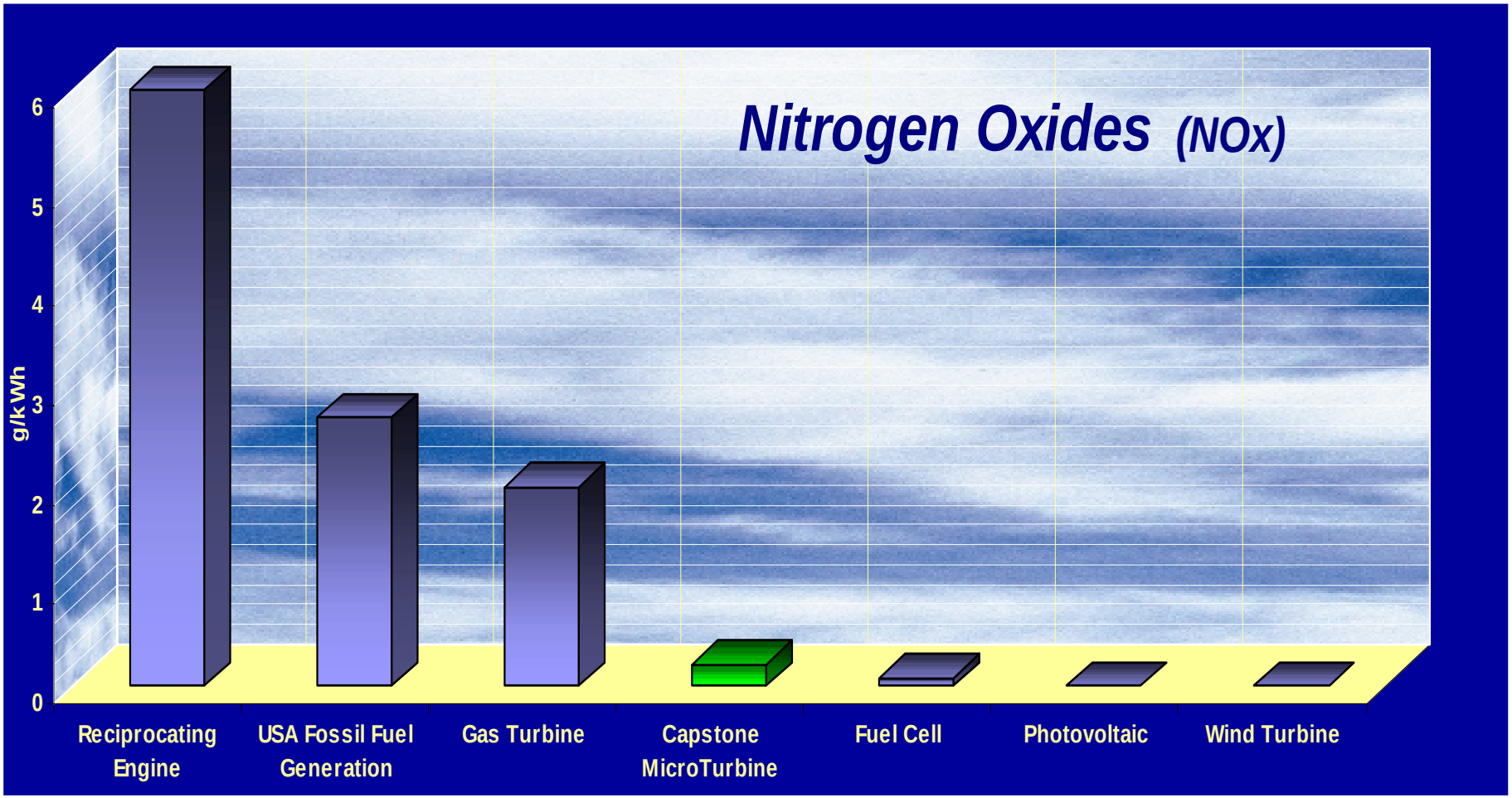
- Generate power where it's used
- Transparent to end-user
- Fast & easy installation & operation
- Boost capacity w/o utility costs/delays
- Ensure a high level of power quality & reliability
- Gives end-users energy cost control
- Maximize energy efficiency via CHP
- Affordable n+1 or greater reliability for critical loads
- Low maintenance and minimal parts inventory
- Multi-fuel capability
- Ultra-low emissions
- Easy scalability
- Remote dispatching
- Multi-unit operation (up to 100 units or 6 MW)
- Stand-alone and grid-connect capability

But…for DG to work, it must be safe, it must be clean, and it must be affordable

MicroTurbines:
…It Must Be Safe

- MicroTurbines should comply with:
  - UL 2200 - the new generator standard
  - UL 508C – power conversion equipment
  - UL 1741 – static inverters
  - IEEE 929, 519
  - NFPA 37, 54, 70
- IEEE nationwide interconnection standard (pending)

MicroTurbines:
… It Must Be Clean



MicroTurbines:
… It Must Be Affordable

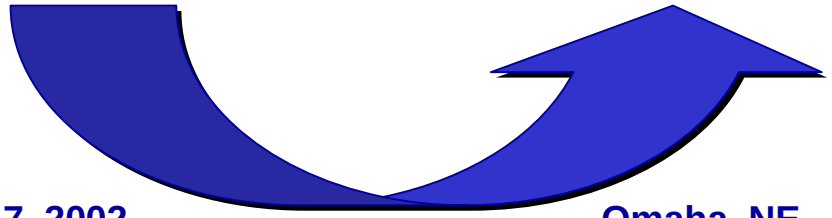
MicroTurbines: Part of the Solution Today

- DG systems can be part of the solution
  - Proven clean, safe, reliable, efficient and cost-effective
  - Well below today's toughest air quality standards
  - Reduces demand on the utility grid during peak times
  - Can be deployed in weeks, not years
- Expand the President's Energy Plan to encourage
  - Use of oilfield gases as fuel
  - Use of digester gases as fuel
  - Use of hybrid-electric technology in PUBLIC transportation

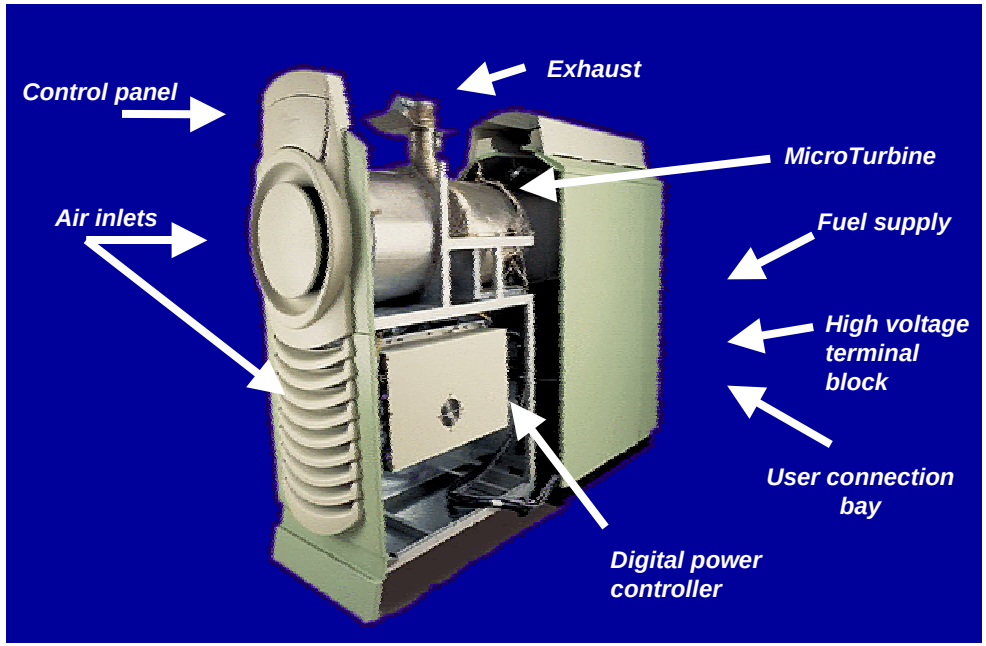
MicroTurbine Technology: Unique Design Characteristics

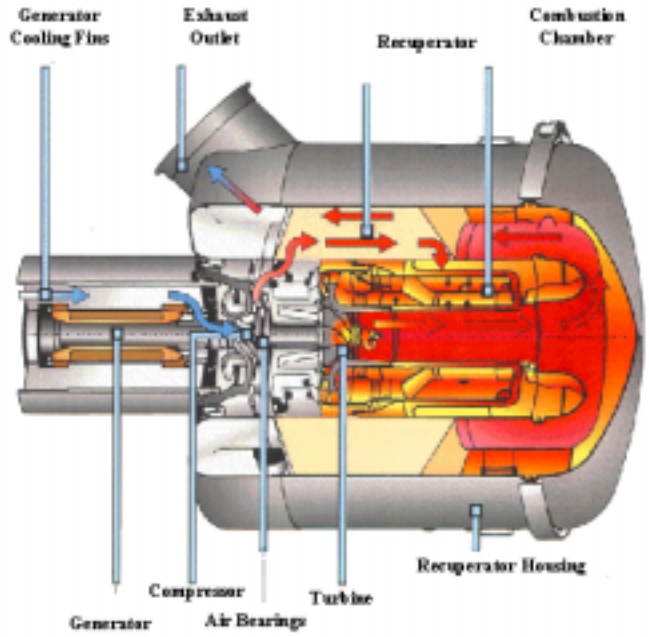
- Integrated system approach
- Simple, low pressure ratio, low temperature, robust design
- Multi fuel capability:
  - Natural Gas, propane, CNG/LNG, methane
  - Up to 7% sour (H_2S) gas
  - Diesel, Kerosene
  - Bio-gas
- Single moving part supported by patented air bearings
  - Eliminates the need for liquid engine lubricants
  - Reduces maintenance costs
  - Increases system life
- Air cooling of the electronics
  - Eliminates need for liquid cooling systems
- Low exhaust and acoustic emissions
  - Less than 9 ppm NOX
  - 65 dba at 10 meters

- **High Reliability**
- **Low Maintenance**
- **Low Emissions**
- **Versatility of Use**



MicroTurbine Technology: Inside the MicroTurbine





MicroTurbine: Performance Data and Specifications

Characteristic	Performance	
	MODEL M330	CAPSTONE 60
Output	30/28 kW Net (+/-1)	60 kW Net (+/-1)
Efficiency	26% (+/-2)	28% (+/-2)
Fuel Flow	410,000 BTU/hr - HHV	871,000 BTU/hr - HHV
Exhaust Temperature	520º F	649º F
Total Exhaust Energy	277,000 BTU/Hr	640,000 BTU/Hr
Projected O&M Costs	$0.008/kWh	
Emissions	NOx (<9 ppmV)	
Noise level	65 dBA at 10 meters	
Voltage	400-480 VAC 3 phase, 50 or 60 Hz	
Weight	1052 LB	1340 LB
Size	74.8”h x 28.1”w x 52.9”d	80”h x 30”w x 76”d

The MicroTurbine™ is smaller in footprint and quieter than conventional generation technologies

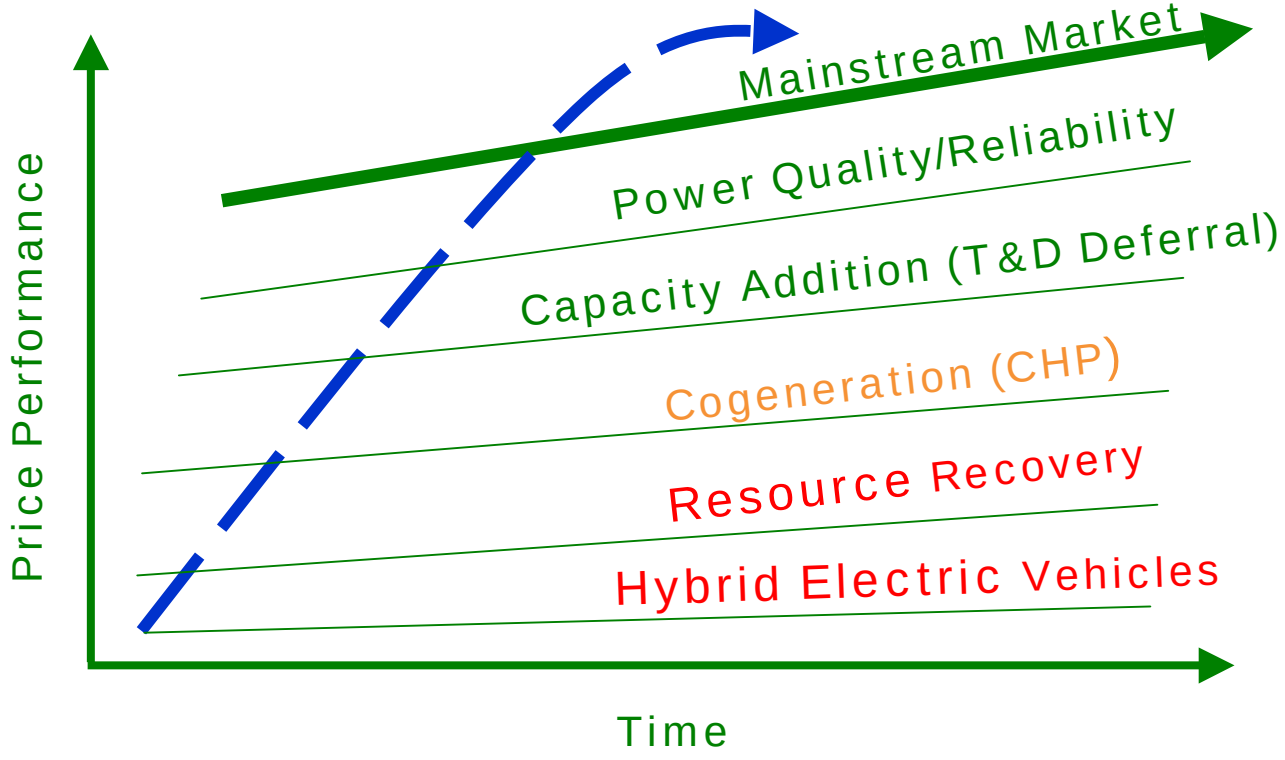
How Do We Compare to Recip's?

	Conventional GenSet	MicroTurbine
Life Resource	**10, 000 to 15,000 hrs**	**40,000 hrs**
Oil Change	**Yes**	**No**
Water Cooling	**Yes**	**No**
Ultra Low Emissions	**No**	**Yes**
Heat Recovery Capability	**Limited**	**Yes**
Paralleling Gear	**Optional**	**Integrated**
Maintenance Frequency	**Monthly**	**Annually**
Grid-Quality Power	**No**	**Yes**
Multipac Configuration	**Requires optional gear**	**Up to 100 units**
Noise Level/Vibration	**Loud/Present**	**As low as 55dBA*/None**

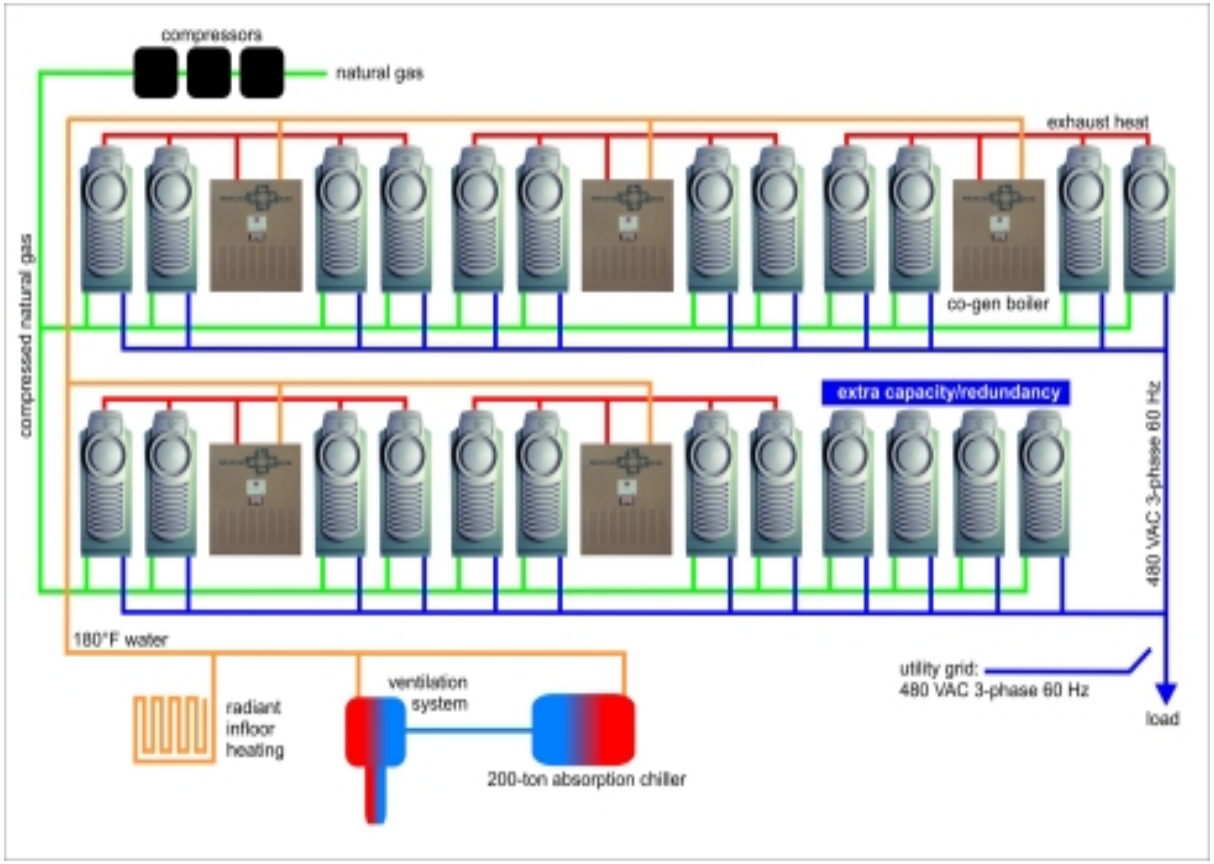
**-With optional silencer kit*

MicroTurbine Applications: Valuable Characteristics

- High Electricity to Fuel Cost Ratio
- Virtually Free Fuel
- Significant Run Time
- Avoided Capital Investment
- Low Maintenance Required
- Exhaust Heat Utilization
- Power Quality Critical
- Strict Air Quality Requirements
- Space considerations



Applications:
Power Quality and Reliability



24-unit 700kW stand-alone MultiPac system with heat recovery installed at a plastics manufacturing facility in New York

Applications:
Federal and Local Government

South California Prison

Denver, CO Police Department

Presidio Trust
Former Military Base
Now Public Park
California

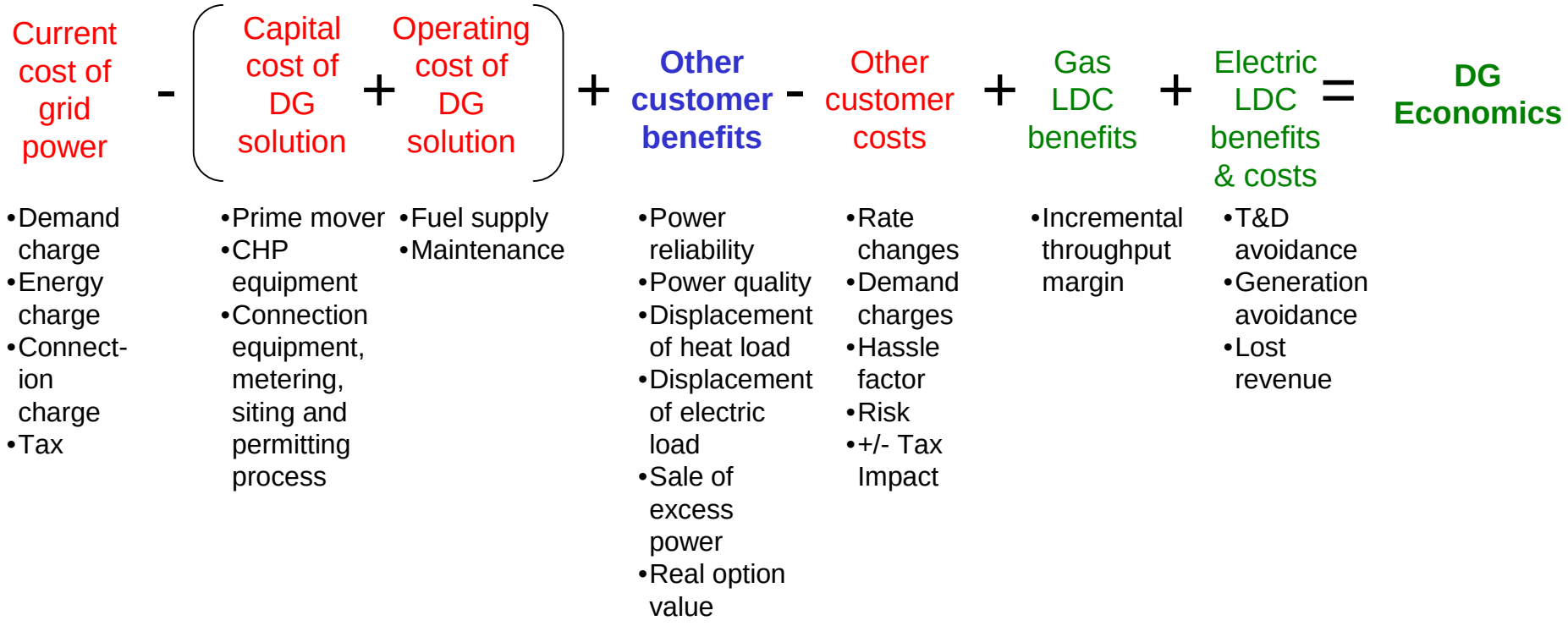
City Hall in California
Powered by wellhead gas

MicroTurbines: Further Developments

- Advanced MicroTurbine targets
  - 120 to 150 kW
  - 40% efficiency
  - 6 ppm NOx
- Hybrid Systems:
  - Fuel cells
  - Storage devices
  - Large generation systems

250 kW fuel cell is used to spin specially modified MicroTurbine

DG Economic Model[1]



1. Adapted from Arthur D. Little publication, “Distributed Generation: Understanding the Economics”

Conclusions:

- **MicroTurbines provide many benefits in addition to their energy economics**
- **The most successful applications take advantage or these unique product attributes and features**
- **Energy economics serve to pay for the cost of delivering the additional benefits**